

CLAIMS

What is claimed is:

1. A method comprising:

forming an admixture of a solvent, an additive and a polymer selected from the group consisting of a precursor to an electrically conductive polymer and an electrically conductive polymer said polymer being soluble in said solvent said polymer not being substantially soluble in said additive in the absence of said solvent;

said additive provides local mobility to said polymer to allow said polymer to associate with one another to achieve a crystalline state; and

removing or partly removing said solvent substantially leaving said additive therein as remaining additive, said remaining additive provides local mobility to said polymer to achieve said crystalline state.

2. A method according to claim 1, wherein said admixture is electrically conductive and has an isotropic electrical conductivity.
3. A method according to claim 1, wherein said additive is selected from the group consisting of plasticizers and diluents.
4. A method according to claim 1, wherein said additive is a plasticizer is selected from the group consisting of:

Adipic acid plasticizers
 Azelaic acid plasticizers
 Benzoic acid plasticizers
 Citric acid plasticizers
 Dimer acid plasticizers
 Epoxy plasticizers
 Fumaric acid plasticizers
 Glycerol plasticizers
 Isobutyrate plasticizers
 Lauric acid plasticizers
 Linoleic acid plasticizers
 Maleic acid plasticizers
 Mellitates
 Myristic acid plasticizers
 Oleic acid plasticizers
 Palmitic acid plasticizers
 Paraffin plasticizers
 Phosphoric acid plasticizers
 Phthalic acid plasticizers
 Ricinoleic acid plasticizers

Sebacic acid plasticizers
 Stearic acid plasticizers
 Succinic acid plasticizers
 Sulfonic acid plasticizers
 Terpentines
 Terpentine plasticizers
 Siloxanes
 Polysiloxanes
 Ethylene glycols
 Polyethylene glycols
 Polyesters
 Sucrose plasticizers
 Tartaric acid plasticizers
 Trimellitic acid plasticizers
 Glycol plasticizers
 Glycolates
 Hydrocarbons
 Phosphonic acid plasticizers
 Polysilanes

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5. A method according to claim 1, wherein said polymer is selected from the group consisting of substituted and unsubstituted polyparaphenylene vinylenes, polyparaphenylenes, polyanilines, polythiophenes, polyazines, polyfuranes, polypyrroles, polyselenophenes, poly-p-phenylene sulfides, polyacetylenes formed from soluble

precursors, combinations thereof and blends thereof with other polymers and copolymers of the monomers thereof.

6. A method according to claim 1, wherein said solvent when removed or partly removed forms a film which is further stretch oriented.

7. A method comprising:

forming a combination of a first material, a second material and a solvent;

said first material is selected from the group consisting of a precursors to an electrically conductive polymer and an electrically conductive polymer;

said second material being soluble in said solvent, said second material not being substantially soluble in said first material in the absence of said solvent.

8. A method according to claim 7, wherein said combination is electrically conductive and has a conductivity which is isotropic.
9. A method according to claim 7, wherein said polymer is selected from the group consisting of substituted and unsubstituted polyparaphenylene vinylenes, polythianophthenes, polyparaphenylenes, polyanilines, polythiophenes, polyazines, polyfuranes, polypyrroles, polyselenophenes, poly-p-phenylene sulfides, polyacetylenes formed from soluble precursors, combinations thereof and blends thereof with other polymers and copolymers of the monomers thereof.

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10. A method according to claim 7, wherein said ^{second natural} ~~plasticizer~~ is selected from the group consisting of:

Adipic acid plasticizers	Sebacic acid plasticizers
Azelaic acid plasticizers	Stearic acid plasticizers
Benzoic acid plasticizers	Succinic acid plasticizers
Citric acid plasticizers	Sulfonic acid plasticizers
Dimer acid plasticizers	Terpentines
Epoxy plasticizers	Terpentine plasticizers
Fumaric acid plasticizers	Siloxanes
Glycerol plasticizers	Polysiloxanes
Isobutyrate plasticizers	Ethylene glycols
Lauric acid plasticizers	Polyethylene glycols
Linoleic acid plasticizers	Polyesters
Maleic acid plasticizers	Sucrose plasticizers
Mellitates	Tartaric acid plasticizers
Myristic acid plasticizers	Trimellitic acid plasticizers
Oleic acid plasticizers	Glycol plasticizers
Palmitic acid plasticizers	Glycolates
Paraffin plasticizers	Hydrocarbons
Phosphoric acid plasticizers	Phosphonic acid plasticizers
Phthalic acid plasticizers	Polysilanes
Ricinoleic acid plasticizers	

11. A method comprising forming a polyaniline material having at least one crystal grain, said material having isotropic electrical conductivity.

12. A method comprising:

providing solution of polymers in a solvent;

said polymers are selected from the group consisting of precursors to electrically conductive polymers and electrically conductive polymers;

providing mobility to said polymers to allow said polymers to associate with one another to achieve a crystalline state by adding a plasticizer to said solvent;

said plasticizer being soluble in said solvent, said plasticizer not being substantially soluble in said polymer in the absence of said solvent.

13. A method according to claim 12, wherein said step of providing mobility is provided by adding an additive to said solution.
14. A method according to claim 13, wherein said additive is selected from the group consisting of a plasticizer and a diluent.
15. A method according to claim 1, wherein said additive contains substituents which facilitates the miscibility of said polymer and said additive.
16. A method according to claim 1, wherein said additive disrupts aggregation of said polymer.
17. A method comprising:

an admixture of polyaniline base, N-methyl pyrrolidinone and a plasticizer;

said plasticizer content is from about 0.001% to about 90% by weight of said admixture;

said plasticizer is selected from the group consisting of poly-co-dimethyl aminopropyl siloxane, polyglycol diacid, 3,6,9-trioxundecaedioic acid and poly (ethylene glycol) tetrahydro furfuryo ether, glycerol triacetate and epoxidized soy bean oil.

18. A method according to claim 17 further including adding a dopant.
19. A method according to claim 18, wherein said admixture further includes m-cresol.
20. A method according to claim 1, wherein said additive deaggregates said polymer.
21. A method according to claim 1, wherein said additive cross-links said polymer.
22. A method according to claim 1, wherein said solvent is extracted from said admixture by a technique selected from the group consisting of solvent extraction and evaporation.
23. A method according to claim 1, wherein said additive is first added to a solvent and thereafter an electrically conducting polyaniline is added which becomes neutralized upon addition to said admixture.
- Sub
A1 24. A method according to claim 1, wherein said admixture contains a polyaniline monomer, said additive and an oxidant.

25. A method according to claim 1, wherein said additive includes a plasticization effect.

26. A method according to claim 1, wherein said additive induces an antiplasticization effect.

27. A method comprising:

forming an admixture of a solvent, an additive and a polymer selected from the group consisting of a precursor to an electrically conductive polymer and an electrically conductive polymer;

said additive provides local mobility to said polymer;

said additive is selected from the group consisting of one or more:

Adipic acid plasticizers

Azelaic acid plasticizers

Benzoic acid plasticizers

Citric acid plasticizers

Dimer acid plasticizers

Epoxy plasticizers

Fumaric acid plasticizers

Glycerol plasticizers

Isobutyrate plasticizers

Isophthalic acid plasticizers

Lauric acid plasticizers

Sebacic acid plasticizers

Stearic acid plasticizers

Succinic acid plasticizers

Sulfonic acid plasticizers

Terpentines

Terpentine plasticizers

Siloxanes

Polysiloxanes

Ethylene glycols

Polyethylene glycols

Polyesters

Linoleic acid plasticizers

Maleic acid plasticizers

Mellitates

Myristic acid plasticizers

Oleic acid plasticizers

Palmitic acid plasticizers

Paraffin plasticizers

Phosphoric acid plasticizers

Phthalic acid plasticizers

Ricinoleic acid plasticizers

Sucrose plasticizers

Tartaric acid plasticizers

Terephthalic acid plasticizers

Trimellitic acid plasticizers

Glycol plasticizers

Glycolates

Hydrocarbons

Phosphonic acid plasticizers

Polysilanes

said solvent is selected from the group consisting of one or more of:

N-methyl pyrrolidinone

dimethyl sulfoxide

dimethyl formamide

pyridine

toluene

xylene

m-cresol

phenol

dimethylacetamide

tetramethylurea

n-cyclohexylpyrrolidinone

aqueous acetic acid

aqueous formic acid

pyrrolidinone

N1N' dimethyl propylene urea (DMPU)

benzyl alcohol

water

dimethylene propylene urea

28. A method comprising:

forming a combination of a first material and a second material;

said second material is a polymer selected from the group consisting of a precursor to an electrically conductive polymer and an electrically conductive polymer;

said second material is selected from the group consisting of:

Adipic acid plasticizers

Azelaic acid plasticizers

Benzoic acid plasticizers

Citric acid plasticizers

Dimer acid plasticizers

Epoxy plasticizers

Fumaric acid plasticizers

Glycerol plasticizers

Isobutyrate plasticizers

Isophthalic acid plasticizers

Lauric acid plasticizers

Sebacic acid plasticizers

Stearic acid plasticizers

Succinic acid plasticizers

Sulfonic acid plasticizers

Terpentines

Terpentine plasticizers

Siloxanes

Polysiloxanes

Ethylene glycols

Polyethylene glycols

Polyesters

Linoleic acid plasticizers

Maleic acid plasticizers

Mellitates

Myristic acid plasticizers

Oleic acid plasticizers

Palmitic acid plasticizers

Paraffin plasticizers

Phosphoric acid plasticizers

Phthalic acid plasticizers

Ricinoleic acid plasticizers

Sucrose plasticizers

Tartaric acid plasticizers

Terephthalic acid plasticizers

Trimellitic acid plasticizers

Glycol plasticizers

Glycolates

Hydrocarbons

Phosphonic acid plasticizers

Polysilanes

said solvent is selected from the group consisting of one or more of:

N-methyl pyrrolidinone

dimethyl sulfoxide

dimethyl formamide pyridine

toluene

xylene

m-cresol

phenol

dimethylacetamide

tetramethylurea

n-cyclohexylpyrrolidinone

aqueous acetic acid

aqueous formic acid

pyrrolidinone

N1N' dimethyl propylene urea (DMPU)

benzyl alcohol

water

dimethylene propylene urea

29. A method comprising:

providing solution of polymers in a solvent; said polymers are selected from the group consisting of precursors to electrically conductive polymers and electrically conductive polymers;

providing mobility to said polymers to allow said polymers to associate with one another to achieve a crystalline state;

said mobility provided by adding to said polymers a plasticizer selected from the group consisting of one or more of:

Adipic acid plasticizers

Azelaic acid plasticizers

Benzoic acid plasticizers

Citric acid plasticizers

Dimer acid plasticizers

Epoxy plasticizers

Fumaric acid plasticizers

Glycerol plasticizers

Isobutyrate plasticizers

Sebacic acid plasticizers

Stearic acid plasticizers

Succinic acid plasticizers

Sulfonic acid plasticizers

Terpentines

Terpentine plasticizers

Siloxanes

Polysiloxanes

Ethylene glycols

Isophthalic acid plasticizers
Lauric acid plasticizers
Linoleic acid plasticizers
Maleic acid plasticizers
Mellitates
Myristic acid plasticizers
Oleic acid plasticizers
Palmitic acid plasticizers
Paraffin plasticizers
Phosphoric acid plasticizers
Phthalic acid plasticizers
Ricinoleic acid plasticizers

Polyethylene glycols
Polyesters
Sucrose plasticizers
Tartaric acid plasticizers
Terephthalic acid plasticizers
Trimellitic acid plasticizers
Glycol plasticizers
Glycolates
Hydrocarbons
Phosphonic acid plasticizers
Polysilanes

said solvent is selected from the group consisting of one or more of:

N-methyl pyrrolidinone
dimethyl sulfoxide
dimethyl formamide
pyridine
toluene
xylene
m-cresol
phenol
dimethylacetamide
tetramethylurea
n-cyclohexylpyrrolidinone

aqueous acetic acid

aqueous formic acid

pyrrolidinone

N1N' dimethyl propylene urea (DMPU)

benzyl alcohol

water

dimethylene propylene urea

30. A method according to claim 27 wherein said additive can range from about 0.001 to about 90% by weight of said admixture.
31. A method according to claim 27 wherein said additive can range from about 0.001 to about 50% by weight of said admixture.
32. A method according to claim 27 wherein said additive can range from about 0.001 to about 25% by weight of said admixture.
33. A method according to claim 28 wherein said second material can range from about 0.001 to about 90% by weight of said combination.
34. A method according to claim 28 wherein said second material can range from about 0.001 to about 50% by weight of said combination.
35. A method according to claim 28 wherein said second material can range from about 0.001 to about 25% by weight of said combination.

36. A method according to claim 29 wherein said plasticizer can range from about 0.001 to about 90% by weight of said combination.
37. A method according to claim 29 wherein said plasticizer can range from about 0.001 to about 50% by weight of said combination.
38. A method according to claim 29 wherein said plasticizer can range from about 0.001 to about 25% by weight of said combination.
39. A method according to claim 27 wherein said additive allows said polymer to associate with one another to achieve a crystalline state.
40. A method according to claim 1 wherein said additive is an oxidant.
41. A method according to claim 7 wherein said material is an oxidant.
42. A method according to claim 12 wherein said plasticizer is an oxidant.
43. A method according to claim 27 wherein said additive is an oxidant.
44. A method according to claim 28 wherein said second material is an oxidant.
45. A method according to claim 29 wherein said plasticizer is an oxidant.